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4. TITLE AND SUBTITLE Inference and Modeling for Repairable Systems and Software				5. FUNDING NUMBERS F49620-94-1-0355	
6. AUTHOR(S) Dr. Asit P. Basu					
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) University of Missouri-Columbia Columbia, MO 65211				8. PERFORMING ORGANIZATION REPORT NUMBER Missouri TR-3	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Air Force Office of Scientific Research/UM 110 Duncan Avenue Suite B115 Bolling AFB, DC 20332-0001				10. SPONSORING/MONITORING AGENCY REPORT NUMBER AFOSR	
11. SUPPLEMENTARY NOTES					
12a. DISTRIBUTION/AVAILABILITY STATEMENT Unlimited				12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Three graduate students have been supported by the grant. And Tricia Jones is currently working with the Principal Investigator, Asit Basu, for her Ph.D. degree in statistics. The other two students, Mary Richardson and Larry Ries have completed their dissertations in December, 1995 and 1997. Interesting results on software reliability theory have been obtained. Comparative studies of existing methods are made. Also criteria are being developed as to when a software can be released to the users. Both Bayesian and frequentist approaches are considered.					
14. SUBJECT TERMS Statistics, Reliability, Bayesian Methods, Nondestructive Evaluation				15. NUMBER OF PAGES 3	
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FINAL TECHNICAL REPORT  
FOR THE PERIOD JUNE 15, 1994 TO SEPTEMBER 14, 1997  
TO  
THE AIR FORCE OFFICE OF SCIENTIFIC RESEARCH  
ON  
INFERENCE AND MODELING FOR REPAIRABLE SYSTEMS AND SOFTWARE  
(AIR FORCE GRANT NO. AFOSR F49620-94-1-0355)  
BY THE  
DEPARTMENT OF STATISTICS  
UNIVERSITY OF MISSOURI-COLUMBIA

PI NAME : BASU, ASIT P.  
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FAX NO.: (573)884-5524

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## PROGRESS REPORT ON INFERENCE AND MODELING FOR REPAIRABLE SYSTEMS AND SOFTWARE (GRANT NO. F49620-1-0355)

1. OBJECTIVES: The primary purpose of this project is to provide support and train a graduate student so that he or she can complete a Ph.D. in Statistics.

2. STATUS OF EFFORT: Three students, Larry Ries Mary Richardson and Tricia Jones, have been supported by the Grant. Mr. Larry Ries completed his Ph.D. dissertation in December 1995. Mary Richardson completed her Ph.D. in 1997. Currently Trish Jones is finishing her dissertation.

3. ACCOMPLISHMENTS: Larry Ries obtained some interesting results in the area of software reliability. He has made a comparative study of some existing methods and has also developed criterion as to when a software can be released to the potential users. Tricia Jones, in collaboration with Dr. Barry McKinney of Rome Laboratory, worked on some design problems related to aircraft reliability. Mary Richardson developed some inference procedures related to software reliability models.

### 4. PERSONNEL SUPPORTED:

Faculty: Asit P. Basu

Graduate Students:

1. Tricia Jones
2. Mary Richardson
3. Larry Ries

5. PUBLICATIONS: in peer-reviewed journals and refereed book chapters during the reporting period.

1. Software Reliability: Statistical Modeling, Estimation and Inference. Ph.D. dissertation by Larry Ries (December, 1995).
2. Power Law Process Models for Nonhomogeneous Poisson Process Change-Points. Ph.D. dissertation by Mary Richardson (July, 1997).
3. Effect of Non-normality on Some Design Problems for Improved Reliability Estimates (1997) Proc. Of Physical Science Section, American Statistical Association. Trish Jones and Asit Basu (1996)

### 6. INTERACTIONS/TRANSITIONS:

#### 6.1 INTERACTIONS

- a) The PI is discussing with Dr. Barry McKinney of Rome Laboratory research topics of mutual interest. A graduate student, Tricia Jones, worked on the project initiated by McKinney, as a part of her Ph.D. dissertation.
- b) The PI attended the following two Air Force conferences:
  1. 3<sup>rd</sup> Aging aircraft conference at WPAFB, September 1995.

2. 4<sup>th</sup> Aging aircraft conference at Air force Academy, July 1996.

The PI explored potential areas of research with the following with a view to developing relevant statistical methods.

- a) Dr. Tom Swift, FAA
- b) Dr. Walter Jones, AFOSR
- c) Mr. Rigo Perez, McDonnell Douglas
- d) Mr. Jim Rudd, WPAFB
- e) Mr. Claire Paul, WPAFB

6.2 Transitions  
NONE

## 7. PATIENT DISCLOSURES:

None

## 8. HONORS

Asit P. Basu was elected Fellow of the following societies:

1. American Association for the Advancement of Science, 1987
2. American Statistical Association, 1983
3. Institute of Mathematical Statistics, 1983
4. Royal Statistical Society, England, 1974

and also was elected

5. Member of International Statistical Institute, 1987.

**ADGMENTATION AWARDS FOR SCIENCE & ENGINEERING RESEARCH TRAINING (AASERT)**  
**REPORTING FORM**

The Department of Defense (DoD) requires certain information to evaluate the effectiveness of the AASERT Program. By accepting this Grant which bestows the AASERT funds, the Grantee agrees to provide 1) a brief (not to exceed one page) narrative technical report of the research training activities of the AASERT-funded student(s) and 2) the information requested below. This information should be provided to the Government's technical point of contact by each annual anniversary of the AASERT award date.

1. Grantee Identification data: (R&T and Grant numbers found on Page 1 of Grant)

- a. University of Missouri-Columbia  
University Name
- b. AFOSR F49620-94-1-0355  
Grant Number
- c. \_\_\_\_\_  
R&T Number
- d. Asit P. Basu  
P.I. Name
- e. From: 6/15/96 To: 9/14/97  
AASERT Reporting Period

NOTE: Grant to which AASERT award is attached is referred to hereafter as "Parent Agreement".

2. Total funding of the Parent Agreement and the number of full-time equivalent graduate students (FTEGS) supported by the Parent Agreement during the 12-month period prior to the AASERT award date.

- a. Funding: \$ 28,762
- b. Number FTEGS: .22

3. Total funding of the Parent Agreement and the number of FTEGS supported by the Parent Agreement during the current 12-month reporting period.

- a. Funding: \$ 73,226
- b. Number FTEGS: 0

4. Total AASERT funding and the number of FTEGS and undergraduate students (UGS) supported by AASERT funds during the current 12-month reporting period.

- a. Funding: \$ 24,578
- b. Number FTEGS: 1.00
- c. Number UGS: 0

**VERIFICATION STATEMENT:** I hereby verify that all students supported by the AASERT award are U.S. citizens.

Asit P. Basu  
Principal Investigator

4/22/98  
Date

PROGRESS REPORT  
FOR THE PERIOD JUNE 15, 1995 TO JULY 31, 1996  
TO  
THE AIR FORCE OFFICE OF SCIENTIFIC RESEARCH  
ON  
INFERENCE AND MODELING FOR REPAIRABLE SYSTEMS AND SOFTWARE  
(AIR FORCE GRANT NO. AFOSR F49620-94-1-0355)  
BY THE  
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PROGRESS REPORT ON INFERENCE AND MODELING FOR REPAIRABLE  
SYSTEMS AND SOFTWARE (GRANT NO. F49620-1-0355)

1. OBJECTIVES: The primary purpose of this project is to provide support and train a graduate student so that he or she can complete a Ph.D. in Statistics.

2. STATUS OF EFFORT: Currently two students, Mary Richardson and Tricia Jones, are being supported by the Grant. Mr. Larry Ries was also supported by the grant. He completed his Ph.D. dissertation in December 1995.

3. ACCOMPLISHMENTS: Larry Ries obtained some interesting results in the area of software reliability. He has made a comparative study of some existing methods and has also developed criterion as to when a software can be released to the potential users. Tricia Jones, in collaboration with Dr. Barry McKinney of Rome Laboratory, is working on some design problems related to aircraft reliability.

4. PERSONNEL SUPPORTED:

Faculty: Asit P. Basu

Graduate Students:

1. Tricia Jones
2. Mary Richardson
3. Larry Ries

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NONE

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